Spring 2021

IE 441-002: Information & Knowledge Engineering Systems

Ismet Buyutahtakin-Toy

IE 441: INFORMATION & KNOWLEDGE ENGINEERING SYSTEMS (ENGINEERING DATA ANALYTICS)
Spring 2021

Instructor:	Ismet Esra Büyüktahtakın Toy, PhD
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Office Phone:	973-596-5705 (voice mail only)

Meeting time:	T-Th 7:30-8:50 am
Meeting format:	Synchronous Online (everybody is remote, but attendance to Class Webex meetings is required)
Pre-requisites:	IE 331 or an equivalent introductory statistics class
Office Hours:	M 2:00-3:30 pm or by appointment Send an email to the intructor to sign up for a virtual meeting during office hours
TA:	Dogacan Yilmaz
TA email:	dy234@njit.edu
TA Office Hours:	W 9:00-10:00 am (synchronous online Webex office hours open to everyone) through the link: https://njit.webex.com/njit/j.php?MTID=mf7b9a30c42d9e6a3a33f0126d8381ec7 or by appointment
Class Webpage:	https://njit.instructure.com/courses/15401

1. COURSE OBJECTIVES

Companies have more data than ever before, requiring new skills in information technology and big data analytics. While the usage, storage, and categorization of incoming data can be automatized, well-trained individuals must convert data into information and perform analytical and quantitative tools to interpret data and make decisions for the future.

The objective of this course is to teach data analytical tools and statistical/optimization skills using Microsoft Excel and hands-on activities to solve engineering problems and to convert real-world large data sets into useful information for decision making. Recent advancements in Excel spreadsheets provide powerful features in data analytics and quantitative modeling. Mastering spreadsheet not only offers tremendous career opportunities for students, but it also enables engineers and managers to formulate and solve complex problems on their computer to aid in decision making.

We will focus on the use of Microsoft Excel and MS Access useful in data analysis and modeling. The goal is to develop analytical skills to interpret data, make better decisions, and have excellent Excel-use skills. Topics include writing formulas and functions using Excel, descriptive statistics, data visualization, descriptive data mining, linear regression, forecasting, problem formulation, optimization models, spreadsheet models, simulation using Excel, and MS Access.

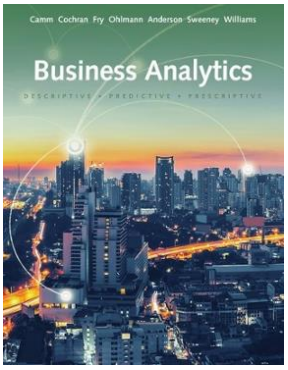
Student Learning Outcomes:

- Explore datasets using MS Excel and MS Access.
- Import, clean, store, sort, and filter data using Excel and Access.
- Build data model, transform raw data, and deliver interactive data visualization.
- Be able to apply basic, intermediate, and advanced formulas and Excel features for data analysis.
- Be able to visualize data using Conditional Formatting.
- Create charts and PivotTables to visualize quantitative data.

- Descriptive Statistics: Numerical Measures: Mean, Median, Mode, Standard Deviation, Correlation, and more.
- Descriptive Statistics: Data Visualization: Charts, Tables, and Dashboards.
- Predictive Statistics: Simple Linear Regression.
- Predictive Statistics: Multiple Linear Regression.
- Predictive Statistics: Time Series Analysis and Forecasting.
- Predictive Statistics: Data Mining Techniques.
- Prescriptive Statistics: Linear Programming Models.
- Prescriptive Statistics: Simulation
- Understand regression methods and their implication on managerial issues.
- Formulate real-life engineering problems as optimization models.
- Learn spreadsheet optimization using model formulation and Excel Solver functions.
- Perform sensitivity analysis to determine the magnitude of change of a model's optimal solution as the data change.

2. REQUIRED COURSE TEXTBOOK AND MATERIALS

a. Textbook. *Essentials for Business Analytics (3rd edition, 2nd* or 1st *editions are also acceptable),* Camm, Cochran, Fry, Ohlman, Anderson, Sweeny & Williams, **(Required)**



b. Microsoft Excel. Microsoft Excel (versions 2013 or 2016 for Windows and 2011 for Mac) with the Solver Add-in and Microsoft Access software. If you are an Apple Mac user, please make sure that you can access a Windows PC. Apple Macs cannot run the advanced data analysis functions in Excel at this moment. All exams will be computerized and be performed on your own PCs while the instructor proctors and records the exams. Using an optimization Solver under Office for Mac 2016 can generate errors in models. If you run into issues, you can try downgrading to an earlier version of Office (2011).

c. **Frontline System's *Risk Solver Platform* and *XLMiner (student version).*** Course code and instructions to download this software will be provided.

d. Class Videos. Weekly class videos will be made available for students to watch on Canvas. Students are not allowed to repost or share course videos anywhere and with anyone outside of the class. Doing so is a violation of the Academic Code of Integrity.

POLICIES AND PROCEDURES

1. GRADE DETERMINATION

Your grade will be determined on the basis of your performance on the activities identified below. One midterm exam and a final exam will be given. Students are required to take three in-class quizzes. They are also expected to complete five assignments (the majority of which will require Excel Solver) to get a passing grade from the course.

No make-ups for exams, projects, or daily work (exercises and quizzes) will be given. No "extra work" will be assigned to individuals as a replacement for, or in addition to, these components.

Additional quizzes or other assignments may be given to everyone in class with or without notice in advance at the instructor's discretion.

a) Point Distribution

Semester grades will be based on the four main scores:

Component	Percentage
Midterm Exam	%20
Final Exam	%25
Assignments (6)	%30
In class-quizzes (3)	%15
Class participation	%10
TOTAL	%100

* Note that final grades will be calculated using the grading scheme above, and so the Total grade column shown in Canvas, which is automatically calculated, does not reflect your final grade. Do not use the percentage grades you see in canvas to calculate your overall grade.

b) Grading Policy

When preparing your assignments and solutions for the exam, pay attention to the content, cleanliness, and organization of the document. They all contribute to your grade. You will be required to upload digital images of your Excel spreadsheet showing your work.

Letter grades will be assigned based on the following criteria as a percentage of total points:

Percent	Grade
92.0 % or above	A
85.0 - 91.9 %	B+
80.0 - 84.9 %	B
70.0 - 79.9 %	C+
65.0 - 69.9 %	C
60.0 - 64.9 %	D
Lower than 60.0 %	F

c) Exams

One midterm exam and a final exam will be given. Both exams will be computer-based. The midterm exam will be held on Thursday, March 11. The final exam will be held on the final exam week, on the day determined by the school. All exams are closed-book and closed-notes. The exams include a set of

problems/questions that are based on the graded problem sets and in-class problems we have covered (e.g., Excel-based problems). The final exam will be cumulative.

Both midterm and final exams will be proctored, where you will be required to upload your Excel spreadsheet showing your work. Exam time and dates are set; they will not be changed. Please make all your arrangements based on the exam dates.

No make-up exams will be given, so missing an exam will result in a zero grade for the exam. However, well-documented special **circumstances (e.g., severe illness or injury, death of a close family member)** could be considered to provide a make-up exam with the instructor's prior approval.

d) Software Assignments and Homework Policy

There will be software assignments where MS EXCEL and Access will be used to solve problems discussed in class. All assignments must be submitted via the Canvas "Assignments" tab by the deadline. Deadlines are based on Eastern Standard Time; if you are in a different time zone, please adjust your submittal times accordingly.

A single excel file should be submitted through Canvas. The answers should be presented in different sheets of the excel file. Each sheet should be appropriately named by the problem and corresponding part name.

You should attempt to solve the questions yourself. If you are stuck, you can discuss problems with me or your classmates. However, you should provide your own solutions and excel file. Plagiarism, i.e., copying somebody else's work will not be tolerated.

Lateness Policy. I encourage you to submit all homework by the due date specified. Late homework will be accepted for up to four days past the due date, but the late penalty will be as follows (note even half-an-hour lateness of the due date will be considered as a day late):

Table: Assignment Late Penalty

Days Late	Late Penalty %
1	15%
2	30%
3	50%
4	60%

e) In-class Quizzes

There will be a 15-20-minute quiz which will have questions similar to problems discussed in class or the homework problems assigned in the previous week. Quizzes will be given at the beginning of the class, and you will be required to upload your work. There will be no make-up quiz.

f) Attendance

The class will meet online through Webex, and your attendance at these Webex meetings is required. Participation includes the following: regular attendance, timely arrival (at least 5 minutes before the class time to set up the computer and Webex), and **participation in in-class problem-solving** and **Webex breakout sessions**. Regular attendance and participation in class are **critical to learning the class material** and will be, therefore, a part of your overall grade.

Class participation will account for 10% of the grades. Absences/tardiness, lack of engagement during classes, and breakout sessions may lower your grade.

In-class problem-solving. An essential part of the attendance grade will be determined based on the submissions of your work during in-class problem-solving sessions. I expect you to work on class exercise problems and submit your work by the end of the class through Canvas under the *Assignments* tab. I often give a chance for students to interact with each other, discuss solution strategies, and learn from each other during Webex breakout sessions in each class.

2. EXAM PROCTORING

Both the midterm and final exams, as well as all quizzes, will be proctored by the instructor through Webex. It will also be recorded. Mute yourself during the exam not to disturb your friends working on the exam questions. If you have questions, use the chatbox to communicate with the instructor.

Follow below webcam and Webex instructions on proctoring:

1. Download the Webex app to your cell phone or an additional device with a webcam, and test it well before the exam day.
2. Connect the class meeting through the Webex app on your cell phone/additional device right before the exam.
3. Locate your cell phone/additional device on your back so that its camera shows your desktop clearly, and I can see you also from the back.
4. Stay in the Webex meeting through your cell phone/additional device until the exam ends. Make sure you have enough battery on your cell phone/other device during the exam.
5. Once you submit your exam, keep the webcam open, showing the submission page on the canvas until the end of the exam.

Note that it is your responsibility to have the Wi-Fi and technical equipment set and connect to the Webex class meeting on time. If there is a violation of any of the exam proctoring rules above, this may result in a zero grade for the exam.

3. CLASS PROTOCOL

- ✓ The course is organized by weekly modules. Each week students must participate in Webex, complete the reading (mostly from the class textbook) or other assignments, and work in groups when asked during the Webex Breakout sessions.
- ✓ Attendance will be taken randomly during the lecture; please be on time.
- ✓ Students should mute themselves during the class, but they should unmute themselves to comment or answer a question. Alternatively, they can use the chat comment in Webex to provide their comments and ask questions.
- ✓ Plan on being present in a quiet place during class meetings as much as possible.
- ✓ Please keep your video on through the entire class. Let me know if you have any technical difficulties regarding the webcam/video. You can also use the virtual background provided by Webex.
- ✓ No web surfing, e-mailing, texting, or any other activity that divides your attention is allowed.

- ✓ There is a Canvas class web page for this class. All material and notices will be posted on the Canvas. Check Canvas for handouts that you might have missed as well as videos/problem sets/grades/data files/assignments/solutions for the course.
- ✓ Check your NJIT email daily as the instructor will use this to communicate information to you between class sessions.
- ✓ The students are encouraged to schedule and attend virtual office hours with the instructor.

2. OTHER POLICIES OR PROCEDURES

a) Academic Honesty

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the University. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Plagiarism is taken seriously and will be dealt with according to university policy. Students must adhere at all times to the NJIT's Code of Academic Integrity.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will face disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the University. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

More on Cheating:

1) Cheating will result in the student receiving a zero grade for the assignment and may result in a failing grade for the class.
2) Turning in an item you did not create is cheating.
3) Copying another person's digital item or work is cheating.
4) Allowing (intended or not intended) someone else to copy your work or digital item is considered cheating and will result in a failing grade for the assignment. This means that you must safeguard your work and computer so that others do not have access to your work or computer.
5) You must do your own work, and do not exchange your work with another student.
6) Having someone complete a homework assignment for you is cheating.

b) Software/Technical Requirements

The software/technical requirements for this course include:

- * High-speed internet connection with a minimum speed of 1.5 Mbps (4 Mbps or higher is recommended). You can check your internet speed at https://fast.com/.
- * Microsoft Excel and MS Access.
- * Webcam and microphone for remote proctoring.

* In addition to your desktop, another device with a webcam (e.g., cell phone, laptop) is required for proctoring purposes.
* Windows or Apple Operating System

NOTE: This course has NOT been designed for use with mobile devices, but you should be able to access most of the digital teaching materials using your cell phones.

c) Canvas

I will use the Canvas class web page to post readings, homework assignments and their solutions, and other course information. Please check there regularly for updates. Please check your NJIT email address regularly. Otherwise, you might be missing some important information.

d) Resources for Online Classes

* Review the NJIT Resources for Students
* If you have any technical difficulty during an online class meeting session, contact IST Help Desk
* Review the Canvas Orientation for Students for extra help
* Review the Webex Tutorials to get yourself familiar with Webex
* Review Resources for NJIT Online Students

e) Students with Disabilities

If you have a disability or a particular need for which you are or may be requesting accommodations, please contact both the Office of Disability Support Services (DSS) and me as early as possible in the semester. The official website is http://www.njit.edu/studentsuccess/disability-support-services-0/. You must submit appropriate documentation to the instructor before accommodations can be granted. DS will review your concerns and determine, with you, what accommodations are necessary and appropriate for you. All information and documentation of your disability is confidential and will not be released by DSS without your written permission.

f) Course Evaluations: Students will be provided an opportunity to evaluate instruction in this course through Canvas using the University's standard procedures, which are administered by the Office of Institutional Effectiveness. The instructor may also provide additional informal surveys within the course to receive students' feedback and comments regarding the class. Feel free to provide your constructive feedback to the instructor regarding the class.

The following is a tentative outline of the course. I may add or remove some topics depending on the interest of the students and the pace of the class. Please tell me if there are other topics that you would like to see covered in the class, and I will do the best I can to accommodate your requests regarding the course content.

TENTATIVE CLASS SCHEDULE

Class Date	Topic(s)
Week 1 (Jan 19 & 21)	Introduction/Syllabus Chapter 1 pg 1-18 Descriptive Statistics Chapter 2 pg 18-82
Week 2 (Jan 16 & 28)	Descriptive Statistics Chapter 2 pg 18-82
Week 3 (Feb 2 & 4)	Data Visualization Chapter 3 pg 82-132
Week 4 (Feb 9 & 11)	Data Visualization Chapter 3 pg 82-132
Week 5 (Feb 16 & 18)	Linear Regression Chapter 7 pg 294-372
Week 6 (Feb 23 & 25)	Multiple Linear Regression Chapter 7 pg 294-372
Week 7 (March 2 & 4)	Time Series Analysis and Forecasting Chapter 8 pg 372-422
Week 8 (March 9 & 11)	Exam Review **Midterm Exam**
Week 9 (March 16 & 18)	**Spring Break**
Week 10 (March 23 & 25)	Time Series Analysis and Forecasting & MS Access Chapter 8 pg 372-422 & Instructor Provided and Appendix B
Week 11 (March 30 & April 1)	Data Management with Access Instructor Provided and Appendix B
Week 12 (April 6 & 8)	Descriptive Data Mining Chapter 9 pg 422-464
Week 13 (April 13 & 15)	Monte Carlo Simulation Chapter 11 pg 500-556
Week 14 (April 20 & 22)	Linear optimization models Chapters 10 & 12 - pg 464-500; pg 556-606
Week 15 (April 27 & 29)	Final Exam Review
Week 16 Final Week	**Final Exam**